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(54) **HEAT RECOVERY DEVICE**

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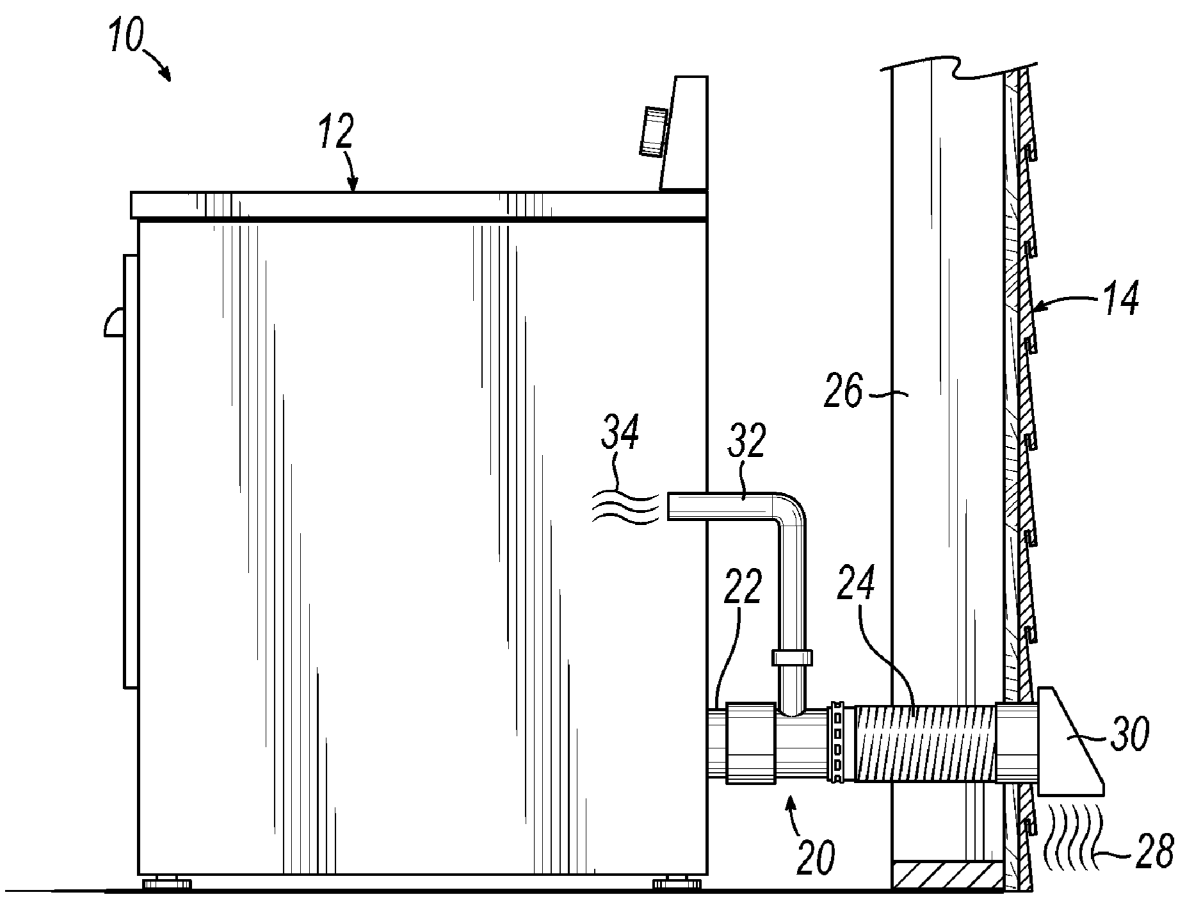
(57) **ABSTRACT**

A heat recovery device for use on a clothes dryer includes a body having a main passageway. The body has a first end and a second end and a dryer exhaust coupling proximate to the first end. The first end has a main flow inlet and the second end has a main flow outlet. The heat recovery device also includes a return air conduit coupled to the body. The return air conduit has a return air inlet and a return air outlet. The return air inlet is disposed within the main passageway and facing the main flow inlet. The dryer exhaust coupling is configured to be removably coupled to a dryer exhaust outlet of a clothes dryer. The return air inlet is configured to receive a portion of the exhaust air discharged from the clothes dryer and discharge that portion through the return air outlet.



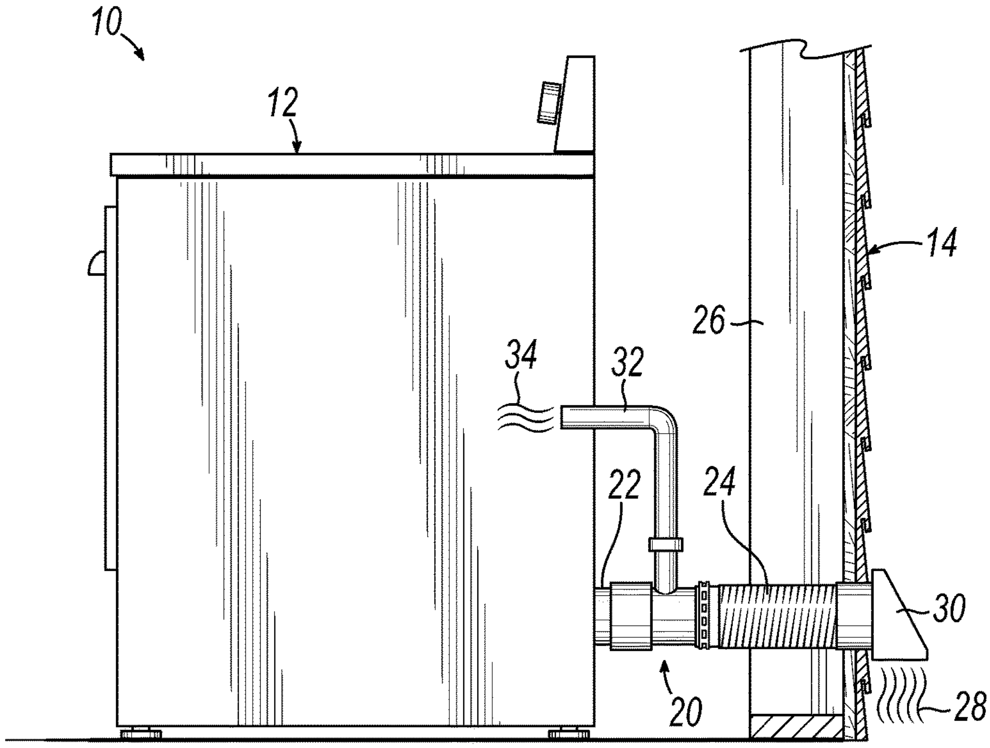


FIG. 1

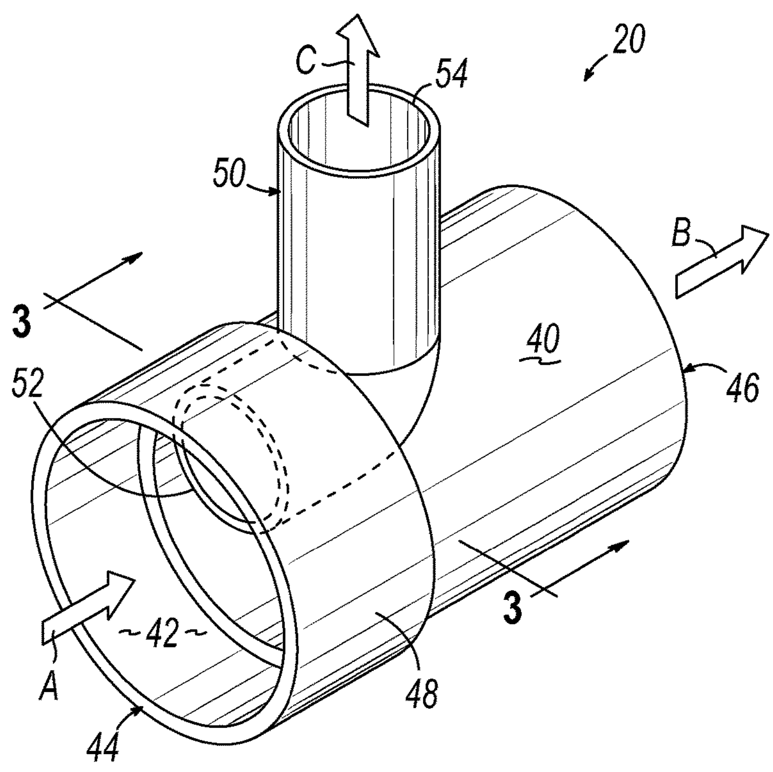


FIG. 2

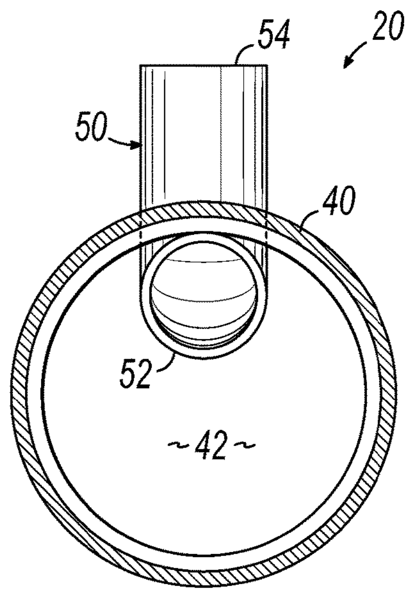


FIG. 3

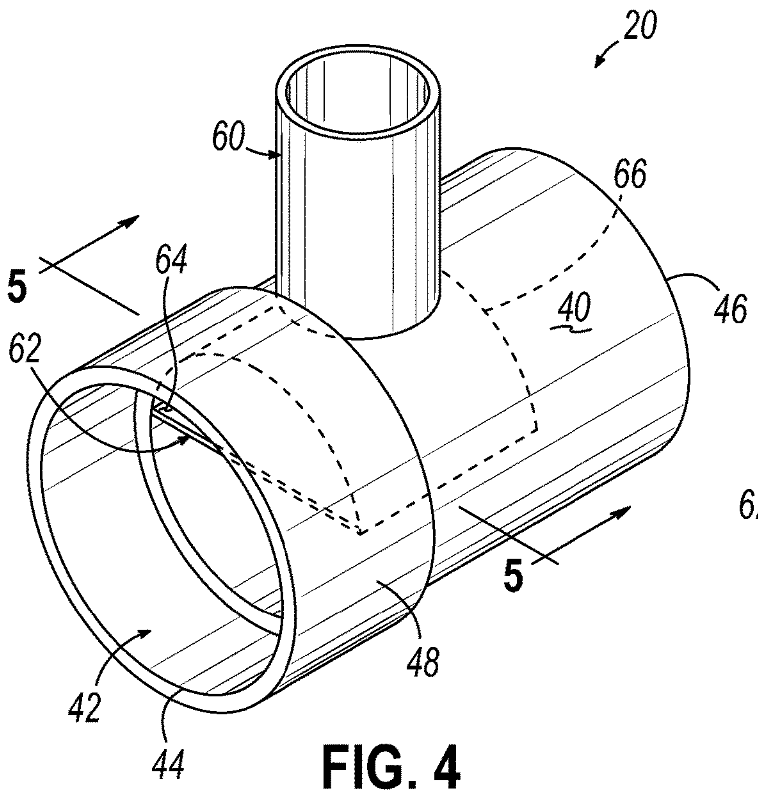


FIG. 4

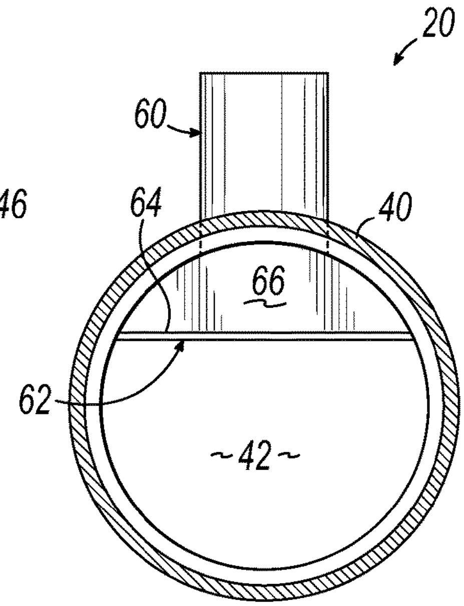


FIG. 5

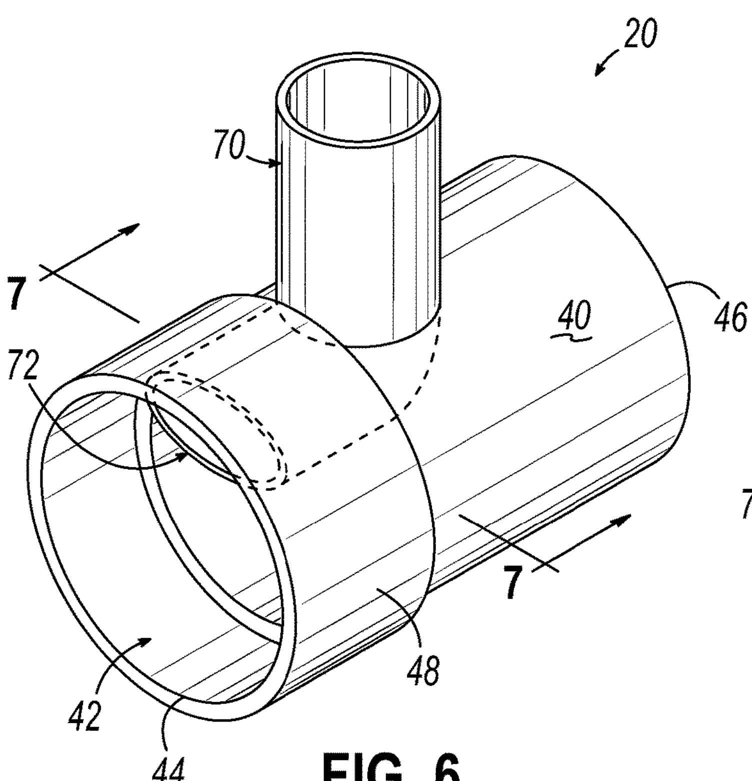


FIG. 6

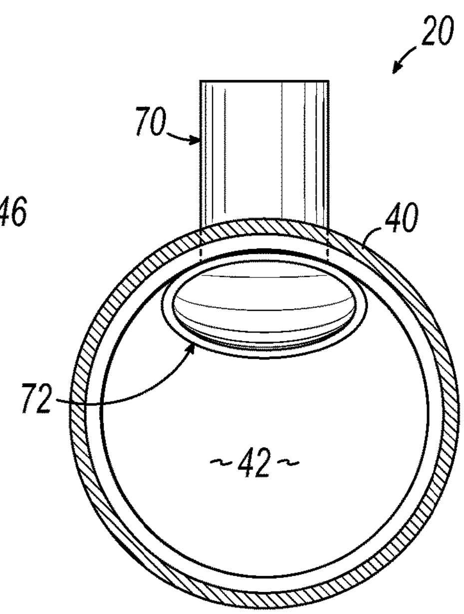


FIG. 7

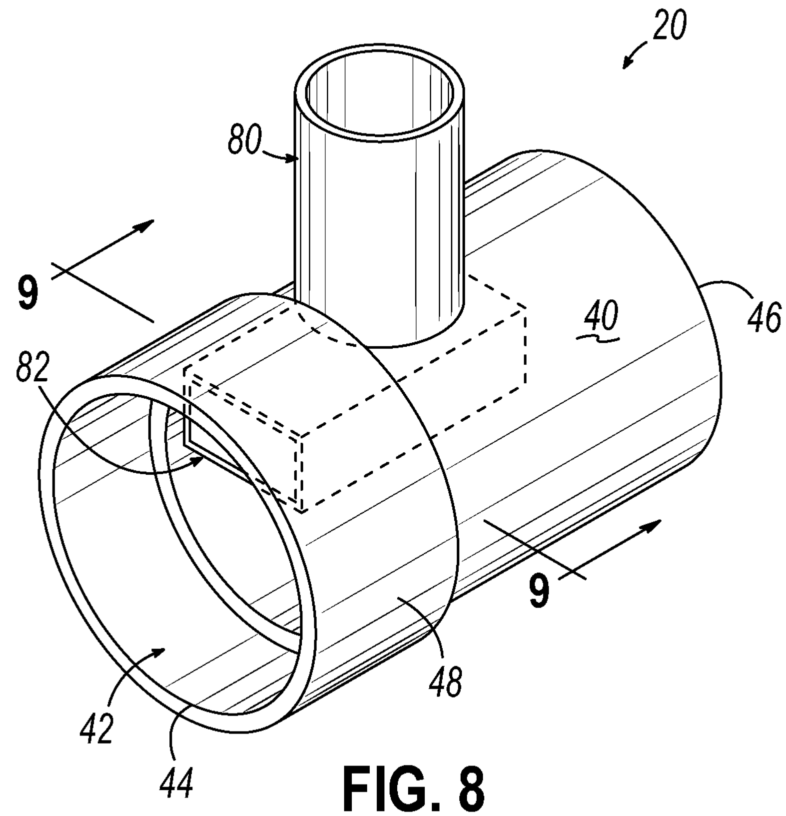


FIG. 8

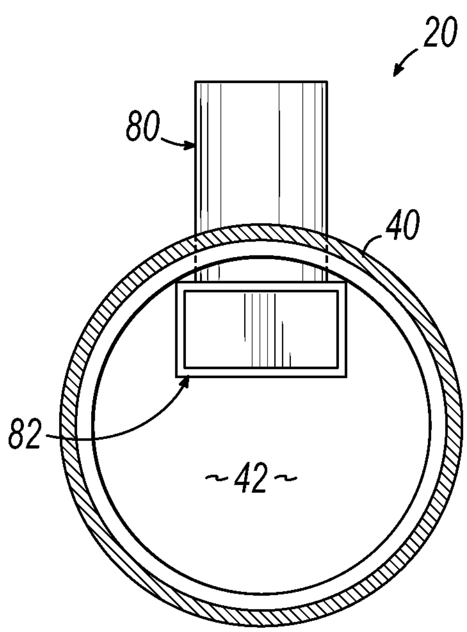


FIG. 9

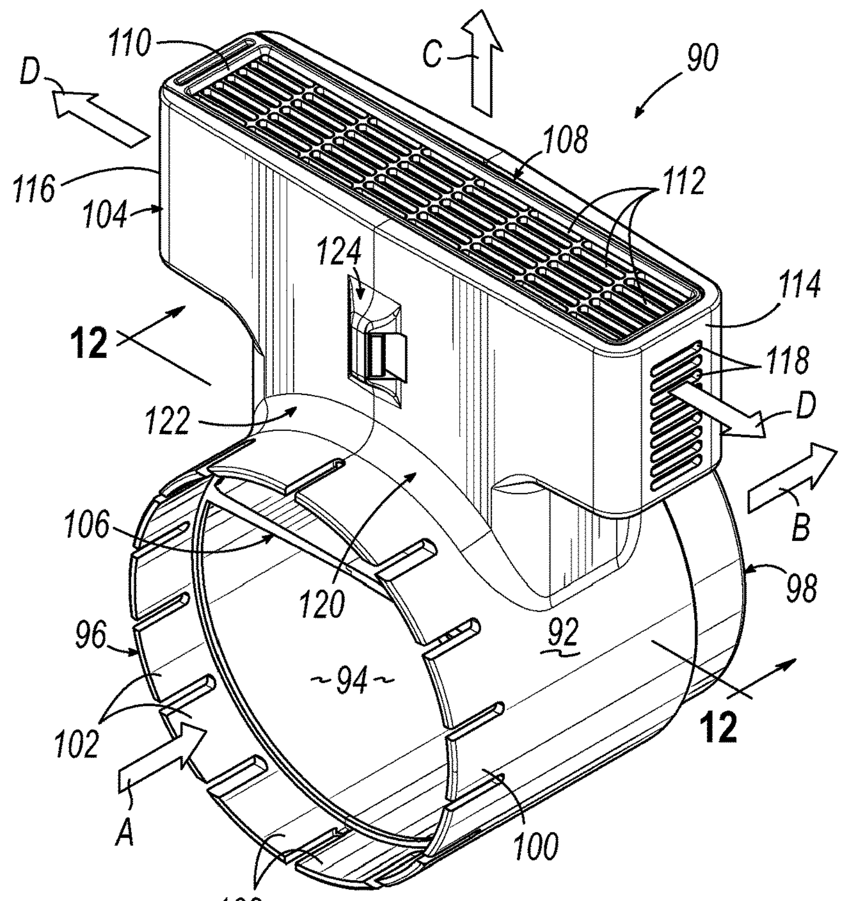

110
D
C
90
108
116
104
112
124
114
12
118
D
122
B
106
120
98
96
92
~94~
102
12
A
100
102

FIG. 10

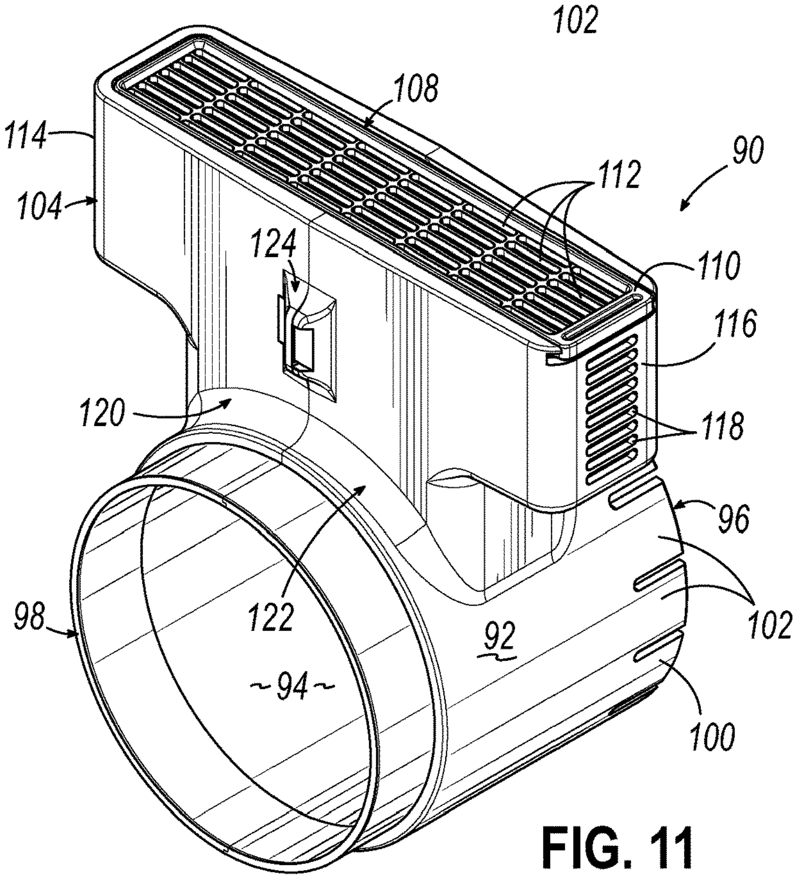

108
114
90
104
112
124
110
116
120
118
96
122
102
98
92
~94~
100

FIG. 11

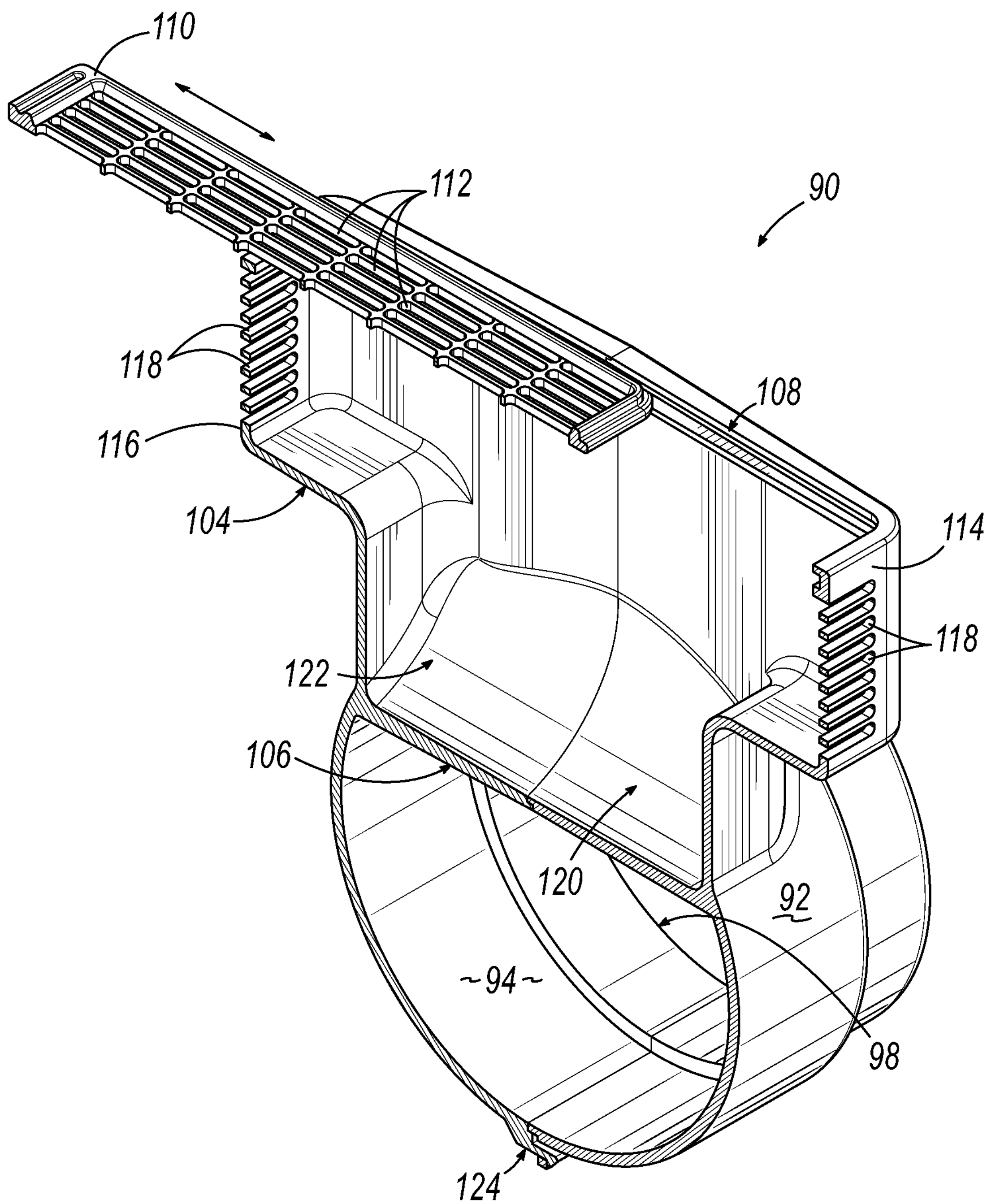


FIG. 12

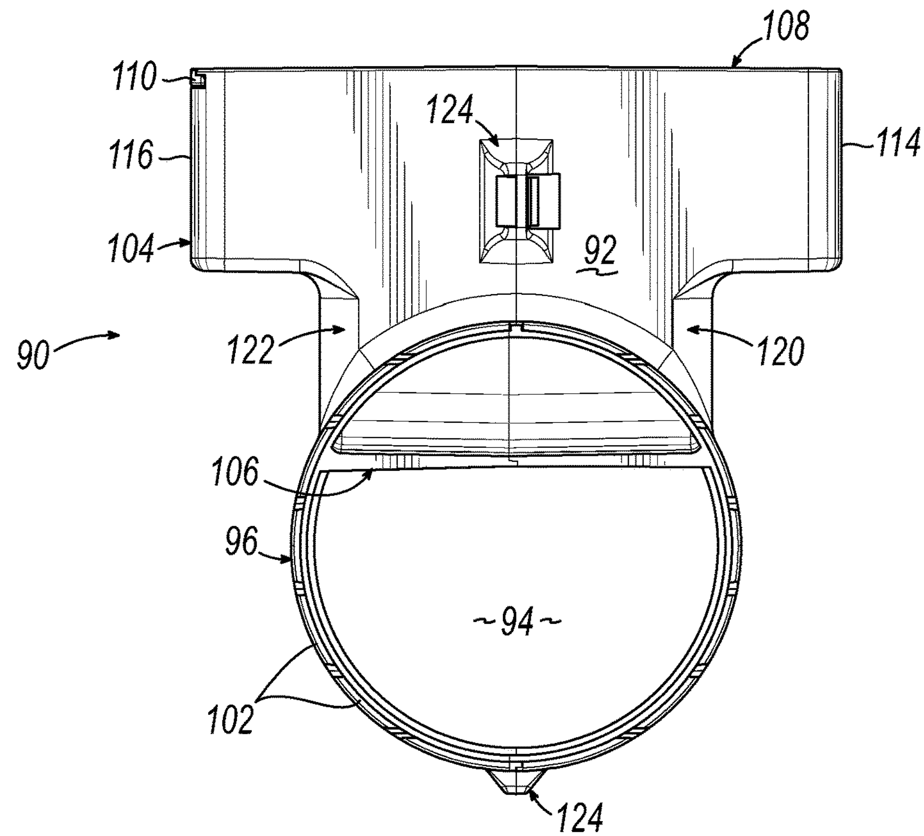

108
110
124
116
114
104
92
90
122
120
106
96
~94~
102
124

FIG. 13

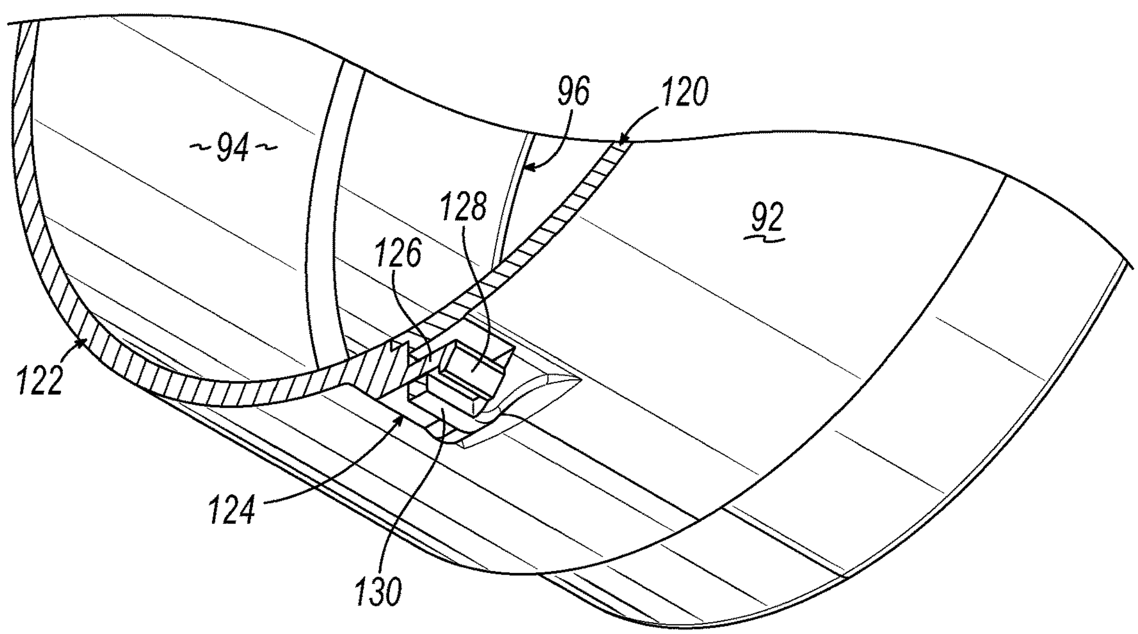

96
120
~94~
128
92
126
122
124
130

FIG. 14

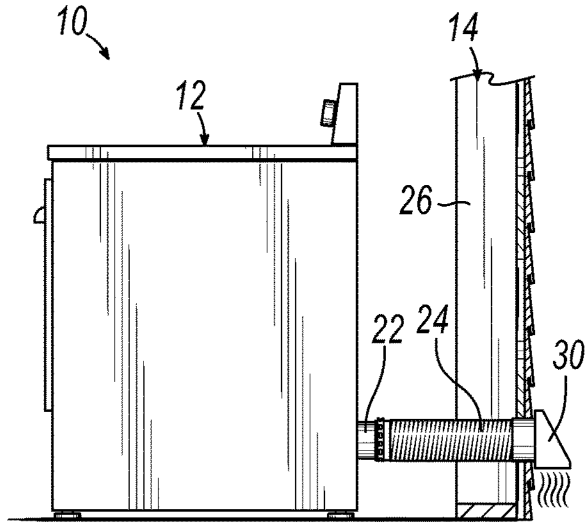


FIG. 15

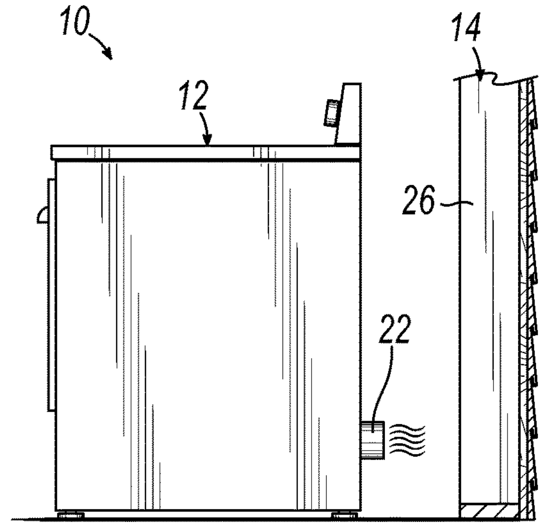


FIG. 16

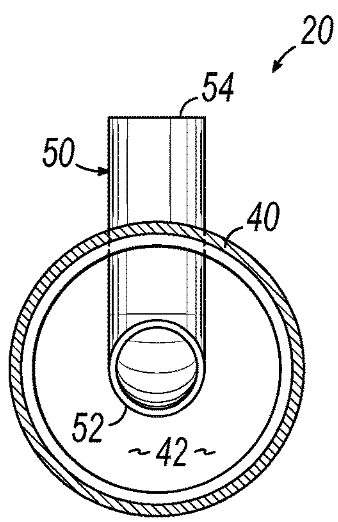


FIG. 17

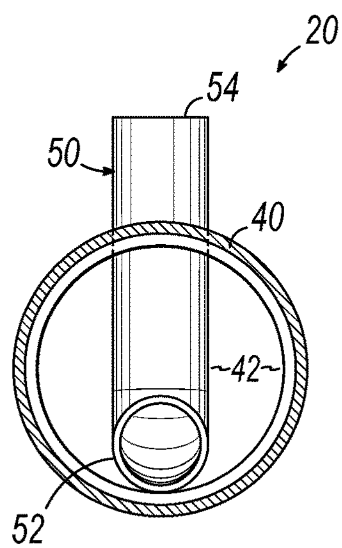


FIG. 18

HEAT RECOVERY DEVICE

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of U.S. Provisional Patent Application Ser. No. 62/715,988, filed Aug. 8, 2018 (pending) and U.S. Provisional Patent Application Ser. No. 62/728,205, filed Sep. 7, 2018 (pending), the disclosures of which are incorporated by reference herein in their entirety.

TECHNICAL FIELD

[0002] The present invention relates to a heat recovery device for use with a clothes dryer.

BACKGROUND

[0003] Electric and gas heated clothes dryers have become common household appliances during the past several decades for drying wet clothes inside a building, such as a house. As part of the typical clothes drying process, the clothes dryer produces hot air. The hot air flows through the wet clothes and is then exhaust to the exterior of the house by way of an exhaust vent. The practice of venting this hot exhaust air outside is particularly inefficient and results in wasted energy, which may result in increased operating costs, especially in recent years with the rapid rise in energy costs for homeowners. There are several problems, however, associated with simply venting the hot exhaust air from the clothes dryer directly back into the interior of the house which is why the conventional practice is to vent the exhaust air to the exterior of the house. For example, the hot exhaust air from the dryer typically contains a certain amount of moisture and lint picked up from the clothes being dried. As a result, it is undesirable to re-circulate the hot exhaust air into the interior of the house or even back into the dryer.

[0004] What is needed, therefore, is a device and method for recovering at least some of the driest hot air that would otherwise be exhausted to the exterior of the house and redirecting that hot air either back into the house or even the clothes dryer.

SUMMARY

[0005] A heat recovery device for use on a clothes dryer includes a body having a main passageway with a central axis. The body has a first end and a second end and a dryer exhaust coupling proximate to the first end. The first end has a main flow inlet and the second end has a main flow outlet. The heat recovery device also includes a return air conduit coupled to the body. The return air conduit has a return air inlet and a return air outlet. The return air inlet is disposed within the main passageway and facing the main flow inlet. The dryer exhaust coupling is configured to be removably coupled to a dryer exhaust outlet of a clothes dryer such that the exhaust air discharged from the clothes dryer flows into the main flow inlet. The return air inlet is configured to receive a portion of the exhaust air discharged from the clothes dryer and discharge that portion through the return air outlet and a remainder of the exhaust air being discharged through the main flow outlet.

[0006] In one embodiment, when the heat recovery device is coupled to the dryer exhaust outlet, the central axis is substantially horizontal. In this embodiment, the return air outlet is configured to discharge the portion of the exhaust air from the clothes dryer in a direction substantially perpendicular to the central axis.

[0007] The return air inlet has a cross-section that is one of circular, semi-circular, elliptical, rectangular, square, or triangular.

[0008] In one embodiment, the return air inlet is disposed in an upper half of the main passageway.

[0009] In another embodiment, a heat recovery device for use on a clothes dryer, includes a body having a main passageway with a central axis. The body has a first end and a second end and a dryer exhaust coupling proximate to the first end. The first end has a main flow inlet and the second end has a main flow outlet. The heat recovery device also includes a return air conduit integrally formed to the body. The return air conduit has a return air inlet and a return air outlet. The return air inlet is disposed within the main passageway and faces the main flow inlet and the return air outlet is disposed outside the main passageway. The body and the return air conduit are comprised of a first half and a second half separable from each other along a plane extending through the central axis. The dryer exhaust coupling is configured to be removably coupled to a dryer exhaust outlet of a clothes dryer such that the exhaust air discharged from the clothes dryer flows into the main flow inlet. The return air inlet is configured to receive a portion of the exhaust air discharged from the clothes dryer and discharge that portion through the return air outlet and a remainder of the exhaust air is discharged through the main flow outlet. In one embodiment, a portion of the return air conduit external to the body has a T-shaped profile. When the heat recovery device is coupled to the dryer exhaust outlet, the central axis may be substantially horizontal. In that configuration, the return air outlet is configured to discharge the portion of the exhaust air from the clothes dryer in a direction substantially perpendicular to the central axis.

[0010] In one embodiment, the heat recovery device further includes one connector affixed to the body and one connector affixed to the return air conduit. Each connector is configured to couple together the first half and the second half.

[0011] In another embodiment, the return air conduit includes a cover with openings and the cover is coupled to the return air outlet. The cover may be slideably removable from the return air outlet and the openings may be elongated slots. The return air conduit may include openings on at least one side of the return air conduit. The return air inlet may have a semi-circular cross-section and the return air inlet is disposed in an upper half of the main passageway.

[0012] Other features of the heat recovery device are contemplated and described and claimed below.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate one or more exemplary embodiments of the invention and, together with the general description of the invention given above, and the detailed description of the embodiments given below, serve to explain the embodiments of the invention.

[0014] FIG. **1** is side elevational view of the heat recovery device installed on a clothes dryer according to one embodiment of the invention.

[0015] FIG. **2** is a perspective view of the heat recovery device of FIG. **1**.

[0016] FIG. **3** is a cross-sectional view of the heat recovery device of FIG. **2** taken along line **3-3**.
[0017] FIG. **4** is a perspective view of a heat recovery device according to another embodiment of the invention.
[0018] FIG. **5** is a cross-sectional view of the heat recovery device of FIG. **4** taken along line **5-5**.
[0019] FIG. **6** is a perspective view of a heat recovery device according to another embodiment of the invention.
[0020] FIG. **7** is a cross-sectional view of the heat recovery device of FIG. **6** taken along line **7-7**.
[0021] FIG. **8** is a perspective view of a heat recovery device according to another embodiment of the invention.
[0022] FIG. **9** is a cross-sectional view of the heat recovery device of FIG. **8** taken along line **9-9**.
[0023] FIG. **10** is a front prospective view of a heat recovery device according to another embodiment of the invention.
[0024] FIG. **11** is rear prospective view of the heat recovery device of FIG. **10**.
[0025] FIG. **12** is a cross-sectional perspective view of the heat recovery device of FIG. **10** taken along line **12-12** with the cover slid partially out.
[0026] FIG. **13** is a front elevational view of the heat recovery device of FIG. **10**.
[0027] FIG. **14** is a partial cross-sectional perspective view of the heat recovery device of FIG. **10**
[0028] FIG. **15** is a side elevational view of a clothes dryer exhausting dryer air to the exterior of a building.
[0029] FIG. **16** is a side elevational view of a clothes dryer exhausting dryer air to the interior of a building.
[0030] FIG. **17** is a cross-sectional view of the heat recovery device of FIG. **2** with the inlet port located near the middle of the main passageway.
[0031] FIG. **18** is a cross-sectional view of the heat recovery device of FIG. **2** with the inlet port located near the bottom of the main passageway.

DETAILED DESCRIPTION

[0032] The invention is intended to return heat, in the form of hot air, that is normally exhausted from a conventional clothes dryer to the exterior of a building, such as a house, and into the environment. According to one aspect of the invention, at least some of the hot air may be returned to the interior of the house, such as into the room where the clothes dryer is located, to heat at least part of the interior of the house. According to another aspect of the invention, at least some of the hot air may be returned back into the clothes dryer to enhance the drying efficiency of the clothes dryer. According to one aspect of the invention, little or none of the moisture and lint which may be entrained in the exhausted hot air from the clothes dryer is returned to the interior of the house or the clothes dryer.

[0033] With reference to FIG. **1**, an exemplary laundry room **10** with a conventional clothes dryer **12** is illustrating venting hot exhaust air from the clothes dryer **12** to the exterior of a building **14**, such as a house. A heat recovery device **20** according to one exemplary embodiment is shown coupled at one end to a dryer exhaust outlet **22** of the clothes dryer **12** and coupled at another end to an exhaust duct **24** which is routed through an exterior wall **26** of the building **14**. Hot exhaust air **28** flowing through the exhaust duct **24** exits through a vent **30**. A conduit **32**, such as pipe or tube, is coupled to the heat recovery device **20**. According to an aspect of the invention, return hot air **34** exits the conduit **32** into the interior of the house **14** as illustrated in FIG. **1**. Alternatively, return hot air **34** may also exit into the clothes dryer **12** instead of the interior of the house **14** according to another aspect of the invention.

[0034] Various embodiments of heat recovery devices are shown in FIGS. **2-12**. Some features of the various embodiments of the heat recovery devices in FIGS. **2-12** are the same or nearly the same. Consequently, the same reference number for such a feature will be used on each embodiment where appropriate.

[0035] The heat recovery device **20** is further illustrated in FIGS. **2** and **3**. The heat recovery device **20** is comprised of a body **40** having a main passageway **42** with a main flow inlet **44** and main flow outlet **46**. The main flow inlet **44** includes a dryer exhaust coupling **48**, which is configured to be coupled in sealing engagement to the dryer exhaust outlet **22** of the clothes dryer **12**. The exhaust duct **24** is coupled in sealing engagement with the main flow outlet **46** of the heat recovery device **20**. The heat recovery device **20** further includes a return air conduit **50** having a return air inlet **52** and a return air outlet **54**, which is in sealing engagement with the conduit **32**. The return air inlet **52** is positioned in the main passageway **42**, and more particularly, near the top of the main passageway **42**. The return air conduit **50** and its return air inlet **52** and return air outlet **54** have a generally circular cross-section, but could have other cross-sectional shapes as will be discussed below.

[0036] With specific reference to FIG. **2**, the flow path of the hot exhaust air from the clothes dryer **12** through the heat recovery device **20** is illustrated. Hot exhaust air being discharged from the dryer exhaust outlet **22** flows into the main flow inlet **44** and into the main passageway **42** as schematically indicated by arrow A. A portion of the hot exhaust air exits through the main flow outlet **46** as schematically indicated by arrow B. The remainder of the hot exhaust air exits through the return air outlet **54** as schematically indicated by arrow C.

[0037] As shown in FIGS. **2** and **3**, the body **40** of the heat recovery device **20** is cylindrical in shape, and sized such that the dryer exhaust coupling **48** and body **40** have similar cross-sectional areas compared to the dryer exhaust outlet **22**. However, the body **40** and the dryer exhaust coupling **48** of the heat recovery device **20** are not limited to these shapes. The dryer exhaust coupling **48** may be threaded or may be sized to produce a frictional or interference fit with the dryer exhaust outlet **22** of the clothes dryer **12** to couple in sealing engagement with the dryer exhaust coupling **48** of the heat recovery device **20**. Similarly, the main flow outlet **46** of the heat recovery device **20** may be sized to produce a frictional or interference fit with the exhaust duct **24**. It will be appreciated that tape, a pipe clamp, zip ties, screws, rivets, or other mechanical fasteners may be used to couple the heat recovery device **20** to the dryer exhaust outlet **22** and the exhaust duct **24**. In one embodiment (FIG. **5**), the heat recovery device **20** is constructed of polyvinyl chloride (PVC), but it may be constructed of any other suitable plastic, rubber, carbon-fiber, metal, or any other suitable material. Moreover, the components of the heat recovery device **20** may each be constructed of different materials as operating conditions warrant. For example, the body **40** may be constructed of PVC while the return air conduit **50** may be constructed of metal.

[0038] The return air inlet **52** of the heat recovery device **20** in FIGS. **2** and **3** has a circular cross-section with a diameter which is smaller than the diameter of the circular cross-section of the main passageway **42** of the body **40**. In the embodiment in FIG. **3**, the diameter of return air inlet **52** is a little more than one-third the diameter of main passageway **42** of the body **40**. By way of example, but not a limitation, the diameter of return air inlet **52** may range from between one-tenth to three-quarters of the diameter of the main passageway **42** of the body **40**. The size and location of the return air inlet **52** may be dictated by how much moist air is desired to be directed back into the laundry room **10**. For instance, someone in drier climates may want more of the moist air directed back into the interior of the house **14**. To that end, a larger return air inlet **52** positioned lower in the body **40** may likely return more moist air back into the interior of the house **14** and a smaller return air inlet **52** positioned at the top of the main passageway **42** of the body **40** may likely return less moist air back into the interior of the house **14**.

[0039] In the embodiment of the heat recovery device **20** shown in FIGS. **2** and **3**, the return air inlet **52** is sized to remain in the upper half of the main passageway **42** of the body **40** to capture the dry hot air while the moist air and lint particulates pass under return air inlet **52** and are exhausted to the exterior of the building **14** via the exhaust duct **24**. It is believed that placing the return air inlet **52** in the upper-half of the main passageway **42** of the body **40** will return the driest air from the dryer exhaust outlet **22** back into the laundry room **10**. In addition, the force of the exhaust airstream exiting from the exhaust outlet **22** is adequate to separate and return the dry air via the return air conduit **50** into the laundry room **10**. As a result, no additional energy is consumed to recover the dry air from the exhaust stream.

[0040] Different shapes and configurations of the return air inlet **52** of the return air conduit **50** would be apparent to one skilled in the art in order to alter the amount of warm air recovered. As such, the shapes and configurations are not limited to the shapes and configurations disclosed herein. In one embodiment shown in FIGS. **4** and **5**, the heat recovery device **20** includes a return air conduit **60** with a return air inlet **62** having a flat surface **64** located in the upper-half of the main passageway **42** of the body **40** and just below where the return air conduit **60** intersects with the body **40**. The flat surface **64** may be located at different positions relative to the top of the main passageway **42** of the body **40** to change the amount of hot air returned to laundry room **10** via conduit **32**. The closer the flat surface **64** is to the top of the main passageway **42** of the body **40** (e.g., around 25% of the diameter of the main passageway **42** from the top), the less hot air that may be directed into the interior of the laundry room **10**. Conversely, the further the flat surface **64** is from the top of the main passageway **42** body **40** (e.g., around 75% of the diameter of the main passageway **42** from the top) the warmer air may be directed into the interior of the laundry room **10**. The flat surface **64** is shown mounted to the sidewalls of the main passageway **42** of the body **40** with a flat, half-moon shaped back portion **66**, curved to couple it to the upper-half of the main passageway **42**.

[0041] In another embodiment shown in FIGS. **6** and **7**, the heat recovery device **20** includes a return air conduit **70** with a return air inlet **72** that has an elliptical cross-section. The upper-half of the elliptical cross-section of the return air inlet **72** generally mimics the shape of the main passageway **42** of the body **40** of the heat recovery device **20**.

[0042] In yet another embodiment shown in FIGS. **8** and **9**, the heat recovery device **20** includes a return air conduit **80** with a return air inlet **82** that has a rectangular cross-section. The return air inlet **82** may also have a square cross-section. In another embodiment, the cross-section of the return air inlet may have triangular cross section.

[0043] Another embodiment of a heat recovery device **90** is shown in FIGS. **10-14**. The heat recovery device **90** is comprised of a body **92** having a main passageway **94** with a main flow inlet **96** and a main flow outlet **98**. The main flow inlet **96** includes a dryer exhaust coupling **100** formed from a series of tabs **102**, which are configured to be coupled in sealing engagement to the dryer exhaust outlet **22** of the clothes dryer **12**. The tabs **102** may be flexible to allow the dryer exhaust coupling **100** to slip over the dryer exhaust outlet **22** to produce a frictional or interference fit. It will be appreciated that tape, a pipe clamp, zip ties, screws, rivets, or other mechanical fasteners may be used to couple the heat recovery device **90** to the dryer exhaust outlet **22** and the exhaust duct **24**. The heat recovery device **90** further includes a return air conduit **104** having a return air inlet **106** and a return air outlet **108**. In one embodiment, the return air conduit **104** is integrally formed with the body **40**. While the return air inlet **106** shown in FIG. **13** has a semi-circular cross-section, other cross-sectional geometries may be used, including but not limited to circular, elliptical, rectangular, square, or triangular. While the portion of the return air conduit **104** that is external to the body **92** has a generally T-shaped profile as seen in FIG. **13**, other profiles may be implemented. The return air outlet **108** has a generally rectangular shape with a slidable cover **110** with openings **112**, such as elongated slots, fit thereover. The cover **110** may be slid partially off or completely removed the return air outlet **108** so that the interior of the return air conduit **104** may be cleaned or to allow greater airflow through the return air outlet **108**. The return air conduit **104** has opposing sides **114**, **116**, with openings **118**, such as elongated slots. The slots **112** and the slots **118** are configured to allow return hot air flow through them. It will be appreciated that the return air outlet **108** may have other shapes such a square or circular, for example. It will be further appreciated that through holes and other types of openings may be used in place of the slots **112** and/or the slots **118** to allow return hot air to flow through them. As shown in FIG. **13**, the bottom of the return air inlet **106** is located approximately one-third of the diameter of the main passageway **94** from the top of the main passageway **94**. In other words, the return air inlet **106** is disposed within the upper portion of the main passageway **94**.

[0044] With specific reference to FIG. **10**, the flow path of the hot exhaust air from the clothes dryer **12** through the heat recovery device **90** is illustrated. Hot exhaust air flows through the main flow inlet **96** and into the main passageway **94** as indicated by arrow A. A portion of the hot exhaust air exits through the main flow outlet **98** as indicated by arrow B. A portion of the hot exhaust air exits through the return air outlet **108**, and more specifically through the slots **112** of the cover **110**, as indicated by arrow C. A portion of the hot exhaust air exits through the slots **118** in opposing sides **114**, **116**, as indicated by arrows D. Unlike the embodiments illustrated in FIGS. **2-9**, the return air conduit **104** is not connected to a conduit, such as conduit **32**, to direct the return hot air into the laundry room **10**. Instead, the return hot air enters the laundry room **10** immediately after exiting through the slots **112**, **118**.

[0045] In an exemplary embodiment, the heat recovery device **90** may be constructed of two, separate halves **120**, **122**, which are held together by three connectors **124**, two on the return air conduit **104** (FIGS. **10**, **11**) and one on the bottom of body **92** (FIGS. **13**, **14**). In one embodiment, the two halves **120**, **122** are joined to each other along a plane extending through the central axis of the main passageway **94**. Each connector **124** includes a flexible member **126** with a retaining member **128** at its distal end. The flexible member **126** is coupled to side **122** of the heat recovery device **90**. A coupling member **130** is coupled to side **120** of the heat recovery device **90**. As the two halves **120**, **122** are move toward each other, the retaining member **128** contacts the coupling member **130** and flexes away from the coupling member **130** as the two halves **120**, **122** continue to be moved toward each other. As the two halves **120**, **122** engage one another, the retaining member **128** moves past the coupling member **130** the flexible member **126** returns to it undeflected position and retaining member **128** engages the coupling member **130** to hold the two halves **120**, **122** of the heat recovery device **90**. It will be appreciated that other connectors may be used to hold the two halves **120**, **122** together, such as screws, nuts and bolts, adhesive, glue, etc. It will also be appreciated that the body **92** of the heat recovery device **90** may be formed as a single, monolithic structure, i.e., as one piece.

[0046] Each embodiment of the heat recovery devices **20**, **90** discussed above includes a main passageway **42**, **94**, which has a central axis. Advantageously, in practice, the heat recovery devices **20**, **90** will be coupled to the clothes dryer **12** such that the central axes of the main passageways **42**, **94** are substantially horizontal and each of the return air outlets **54**, **108** discharge return air substantially perpendicular to the central axis in a substantially vertical direction.

[0047] As mentioned above, the position of the return air inlet in the main passageway is likely to influence the amount of moisture in the returned hot air being discharged into the laundry room. That is, the return air inlet may be positioned to collected drier air or positioned to collect moister air. To evaluate the position of the return air inlet on the amount of moist in the returned hot air, the inventor conducted five tests. The five tests were conducted to evaluate how the temperature and humidity inside a laundry room containing a conventional, electric residential clothes dryer changed under varying venting configurations. The five tests were conducted in a laundry room measuring 5 feet by 6 feet with the laundry room door closed. Each test began with removing five beach towels from conventional, residential clothes washing machine after completing a normal wash cycle and placing them into the clothes dryer. The dryer was run for 30 minutes on the high heat setting. A temperate and humidity monitor made by ACU RITE™ sitting directly on the top center of the dryer was used to measure temperature and humidity immediately before and immediately after the drying cycle. None of the dryer exhaust was diverted back into the dryer during any of the five tests.

[0048] In Test No. 1, the dryer exhaust was vented directly to the outside like a typical clothes dryer is usually set-up and operated as schematically illustrated in FIG. **15**. That is, a heat recovery device of the type discussed above was not used and no dryer exhaust was intentionally diverted into the laundry room.

[0049] In Test No. 2, all of the dryer exhaust was vented directly into the laundry room as schematically illustrated in FIG. **16**. In other words, nothing was attached to the dryer exhaust pipe.

[0050] In Test No. 3, the heat recovery device **20** similar to the one shown in FIGS. **2** and **3** was used. The dryer exhaust coupling **48** of the heat recovery device **20** was attached to the dryer exhaust outlet **22** and the main flow outlet **46** of the heat recovery device **20** was attached to the exhaust duct **24** which was attached to the vent **30**. The return air conduit **50** was positioned such that return air inlet **52** was in the most upwardly vertical position in the main passageway **42** of the body **40** of the heat recovery device **20** as illustrated in FIG. **3**. In this configuration, a portion of the dryer exhaust exited through the vent **30** and a portion of the dryer exhaust exited the return air conduit **50** into the laundry room.

[0051] In Test No. 4, the heat recovery device **20** was connected to the clothes dryer in the same manner as in Test 3, but the return air conduit **50** was positioned such that the centerline of the return air inlet **52** was concentric with the centerline of the main passageway **42** of the body **40** of the heat recovery device **20** as illustrated in FIG. **17**. Like Test No. 4, a portion of the dryer exhaust exited through the vent **30** and a portion of the dryer exhaust exited the return air conduit **50** into the laundry room.

[0052] In Test No. 5, the heat recovery device **20** was connected to the clothes dryer in the same manner as in Test 3, but the return air conduit **50** was positioned in the most vertically downward position in the main passageway **42** of the body **40** of the heat recovery device **20** as illustrated in FIG. **18**. Again, a portion of the dryer exhaust exited through the vent **30** and a portion of the dryer exhaust exited the return air conduit **50** into the laundry room.

[0053] The table below summarizes the data that the temperate and humidity monitor collected during the five tests.

Test No.	Test Description	Starting Temp. (F.)	Ending Temp. (F.)	Temp. Change (F.)	Starting Humidity (%)	Ending Humidity (%)	Humidity Change (%)	Comments
1	Typical connection	75	77	+2	45	46	+1	No visible moisture on walls or ceiling of laundry room

-continued

Test No.	Test Description	Starting Temp. (F.)	Ending Temp. (F.)	Temp. Change (F.)	Starting Humidity (%)	Ending Humidity (%)	Humidity Change (%)	Comments
2	Venting directly to laundry room	75	111	+36	42	99	+57	Walls showed visible wetness. Ceiling showed significant wetness, including beads of water.
3	Inlet port in top position	75	82	+7	45	49	+4	No visible moisture on walls or ceiling of laundry room
4	Inlet port in middle position	75	80	+5	43	53	+10	No visible moisture on walls or ceiling of laundry room
5	Inlet port in bottom position	75	81	+6	41	57	+16	Slightly visible wetness on walls and ceiling.

[0054] When looking at the data from Test Nos. 3-5, Test No. 3 yielded the greatest temperature gain, a rise of 7 degrees, and the lowest increase in humidity, a rise of 4 percentage points. Test No. 5 yielded the highest increase in humidity, 16 percentage points.

[0055] While the present invention has been illustrated by a description of various preferred embodiments and while these embodiments have been described in some detail, it is not the intention of the inventor to restrict or in any way limit the scope of the appended claims to such detail. Additional advantages and modifications will readily appear to those skilled in the art. Thus, the various features of the invention may be used alone or in any combination depending on the needs and preferences of the user.

What is claimed is:

1. A heat recovery device for use on a clothes dryer, comprising:

a body having a main passageway with a central axis, the body having a first end and a second end and a dryer exhaust coupling proximate to the first end, the first end having a main flow inlet and the second end having a main flow outlet; and

a return air conduit coupled to the body, the return air conduit having a return air inlet and a return air outlet, the return air inlet disposed within the main passageway and facing the main flow inlet;

wherein the dryer exhaust coupling is configured to be removably coupled to a dryer exhaust outlet of a clothes dryer such that the exhaust air discharged from the clothes dryer flows into the main flow inlet, and

wherein the return air inlet is configured to receive a portion of the exhaust air discharged from the clothes dryer and discharge that portion through the return air outlet and a remainder of the exhaust air being discharged through the main flow outlet.

2. The heat recovery device of claim **1**, wherein when the heat recovery device is coupled to the dryer exhaust outlet, the central axis is substantially horizontal.

3. The heat recovery device of claim **2**, wherein the return air outlet is configured to discharge the portion of the exhaust air from the clothes dryer in a direction substantially perpendicular to the central axis.

4. The heat recovery device of claim **1**, wherein the return air inlet has a cross-section that is one of circular, semi-circular, elliptical, rectangular, square, or triangular.

5. The heat recovery device of claim **1** wherein the return air inlet is disposed in an upper half of the main passageway.

6. The heat recovery device of claim **1**, wherein the return air conduit includes a cover with openings, the cover coupled to the return air outlet.

7. The heat recovery device of claim **6**, wherein the cover is slideably removable from the return air outlet and the openings are elongated slots.

8. The heat recovery device of claim **6**, wherein the return air conduit includes openings on at least one side of the return air conduit.

9. A heat recovery device for use on a clothes dryer, comprising:

a body having a main passageway with a central axis, the body having a first end and a second end and a dryer exhaust coupling proximate to the first end, the first end having a main flow inlet and the second end having a main flow outlet; and

a return air conduit integrally formed to the body, the return air conduit having a return air inlet and a return air outlet, the return air inlet disposed within the main passageway and facing the main flow inlet, the return air outlet disposed outside the main passageway;

wherein the body and the return air conduit are comprised of a first half and a second half separable from each other along a plane extending through the central axis,

wherein the dryer exhaust coupling is configured to be removably coupled to a dryer exhaust outlet of a clothes dryer such that the exhaust air discharged from the clothes dryer flows into the main flow inlet, and

wherein the return air inlet is configured to receive a portion of the exhaust air discharged from the clothes dryer and discharge that portion through the return air outlet and a remainder of the exhaust air being discharged through the main flow outlet.

10. The heat recovery device of claim **9**, further comprising one connector affixed to the body and one connector affixed to the return air conduit, each connector configured to couple together the first half and the second half.

11. The heat recovery device of claim **9**, wherein a portion of the return air conduit external to the body has a T-shaped profile.

12. The heat recovery device of claim **9**, wherein the return air conduit includes a cover with openings, the cover coupled to the return air outlet.

13. The heat recovery device of claim **12**, wherein the cover is slideably removable from the return air outlet and the openings are elongated slots.

14. The heat recovery device of claim **12**, wherein the return air conduit includes openings on at least one side of the return air conduit.

15. The heat recovery device of claim **9**, wherein the dryer exhaust coupling is formed from a plurality of flexible tabs configured to be removably coupled to the dryer exhaust outlet of the clothes dryer.

16. The heat recovery device of claim **9**, wherein the return air inlet has a semi-circular cross-section and the return air inlet is disposed in an upper half of the main passageway.

17. The heat recovery device of claim **9**, wherein when the heat recovery device is coupled to the dryer exhaust outlet, the central axis is substantially horizontal.

18. The heat recovery device of claim **17**, wherein the return air outlet is configured to discharge the portion of the exhaust air from the clothes dryer in a direction substantially perpendicular to the central axis.

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